REMARKS

This paper is being submitted in response to the Office Action mailed June 6, 2005, for the above-referenced application. In this response, Applicants have amended claim 6 and added new claim 18 to clarify that which Applicants regard as the invention. Further, Applicants have amended the specification for purposes of clarification. Applicants respectfully submit that the amendments to the claims and the new claim are fully supported by the originally-filed specification and that the amendments to the specification do not add new subject matter. Additionally, Applicants submit herewith a Terminal Disclaimer, as discussed below.

The rejection of claims 1, 2 and 4-17 for obviousness-type double patenting over claims of U.S. Patent No. 6,655,324 has been addressed by the submission of a Terminal Disclaimer herewith. Accordingly, Applicants respectfully request that this rejection be withdrawn.

The rejection of claims 1, 2 and 4-17 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,666,923 to Collier Jr. et al. (hereinafter "Collier") is hereby traversed and reconsideration is respectfully requested.

Independent claim 1 recites an internal combustion engine system. The system includes an internal combustion engine operating on at least one of ethanol, methanol, natural gas and propane, the engine having a compression ratio in the range of 11-16. Further the system includes means for introducing into the engine fuel/air mixtures including an amount of hydrogen to substantially eliminate misfire at a first equivalence ratio in the range of -.4 - 0.7 when the engine is operating below a selected torque or power level. Fuel/air mixtures are

introduced into the engine at a second equivalence ratio range wherein the second equivalence ratio is greater than the first equivalence ratio when the engine is operated above the selected torque or power level, the second equivalence ratio being sufficiently low at all times to prevent knock. Further, the system includes a knock sensor to detect knock in the engine.

Independent claim 2 recites an internal combustion engine system. The system includes an internal combustion engine operating on at least one of ethanol, methanol, natural gas and propane, the engine having a compression ratio in the range of 11-16. Further the system includes means for introducing into the engine EGR along with a stoichiometric fuel/air mixture including hydrogen sufficient to prevent misfire and wherein the amount of EGR is always sufficient to prevent knock.

Independent claim 4 recites an internal combustion engine system. The system includes an internal combustion engine having a compression ratio in the range of 11-16. Hydrogen is inhomogeneously injected into a cylinder of the engine, wherein the injection of hydrogen is stratified such that a concentration of hydrogen injected in a region close to a spark plug is larger than at any other region within the cylinder. Further, EGR is introduced into the engine. Claim 5 depends from independent claim 4.

Independent claim 6, as amended herein, recites an internal combustion engine system. The system includes an internal combustion engine having a compression ratio in the range of 11-16. Hydrogen is inhomogeneously injected into a cylinder of the engine, wherein the injection of hydrogen is stratified such that a concentration of hydrogen injected in a region close

to a spark plug is larger than at any other region within the cylinder. Further, a knock sensor detects knock in the engine.

Independent claim 7 recites an internal combustion engine. The system includes an internal combustion engine having a compression ratio in the range of 11-16. Hydrogen is inhomogeneously injected into a cylinder of the engine, wherein the injection of hydrogen is stratified such that a concentration of hydrogen injected in a region close to a spark plug is larger than at any other region within the cylinder. Further, a knock sensor detects knock in the engine, and wherein the means for inhomogeneously injecting hydrogen varies hydrogen injection such that a misfire does not occur as an equivalence ratio increases.

Independent claim 8 recites an internal combustion engine system including an internal combustion engine, said engine having a compression ratio in the range of approximately 11 to 16. At least one valve introduces EGR into said internal combustion engine along with a stoichiometric fuel/air mixture including hydrogen sufficient to prevent misfire and wherein the amount of EGR is sufficient to prevent knock. Claims 9-12 and 18 depend from independent claim 8.

Independent claim 13 recites a method for controlling an internal combustion engine including operating an internal combustion engine having a compression ratio in the range of 11 to 16. EGR is introduced into said internal combustion engine along with a stoichiometric fuel/air mixture including hydrogen sufficient to prevent misfire and wherein the amount of EGR is sufficient to prevent knock. Claims 14-17 depend from independent claim 13.

Collie describes a method that uses a variable mixture of natural gas and hydrogen in an engine that operates at variable air/fuel ratios. Hydrogen addition is used to extend the degree of lean operation at low power while high power operation (for acceleration, merging, climbing) uses near stoichiometric mixtures. A set of sensors is used to monitor for misfire in the natural gas engine. Applicants submit that Collier does not consider the effect of knock on the control scenario and sensors are not used to measure knock. Specifically, the Office Action identifies element 6 in Fig. 22 of Collier as a "knock sensor"; however, col. 20, lines 37-39 identify this component as an emission sensor which can monitor NOx, CO, CO_2, THC, NMOG and O_2 passing into the muffler. Applicants submit that the emission sensor 6 of Collier is not a knock sensor to detect knock in the engine, as recited by Applicants, and Collier does not disclose introducing fuel/air mixtures including hydrogen at first and second equivalence ratios, wherein the second equivalence ratio is sufficiently low at all times to prevent knock.

Furthermore, Collier also fails to consider the use of EGR for torque and power control and does not take the effect of EGR knock limit into account. Applicants respectfully submit that Collier does not disclose introducing into the engine EGR along with a stoichiometric fuel/air mixture including hydrogen sufficient to prevent misfire and wherein the amount of EGR is always sufficient to prevent knock, as recited by Applicants.

Moreover, specifically with respect to claims 4, 6, 7, 9 and 14, Applicants submit that Collier does not disclose inhomogeneously injecting hydrogen into a cylinder of the engine, wherein the injection of hydrogen is stratified such that a concentration of hydrogen injected in a

region close to a spark plug is larger than at any other region within the cylinder, as is recited by Applicants. Applicants note that these features were previously considered allowable and have not been specifically addressed in the detailed remarks section of the present Office Action.

Accordingly, for the reasons set forth above, Applicants respectfully submit that the cited prior art does not teach or fairly suggest at least the above-noted features as claimed by Applicants.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding objections and rejections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4792.

Respectfully submitted,
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